Claims

What is claimed is:

1. An electronic brake control system for a vehicle comprising:

a master brake cylinder;

a hydraulic control valve connected to said master brake signal, said control valve including a plurality of solenoid valves for controlling the vehicle wheel brakes;

a plurality of wheel brakes connected to said hydraulic control valve, each of said wheel brakes associated with one of the vehicle wheels and responsive to operation of said solenoid valves in said control valve to brake said associated wheel;

a pair of wheel speed sensors associated with the vehicle front vehicle wheels, each of said wheel speed sensors operative to generate a speed signal that is representative of the rotational speed of one of the front wheels;

a single wheel speed sensor associated with the vehicle rear wheels, said wheel speed sensor operative to generate a speed signal that is representative of the rear axle speed; and

an electronic control unit electrically connected to said control valve and said wheel speed sensors, said electronic control unit operative to monitor said front wheel speed signals and, upon detecting excessive slippage of one of the vehicle front wheels and the rear axle while the vehicle is launching, causing said control valve to apply the front and rear wheel brakes on the same side of the vehicle as the slipping front wheel, whereby engine torque is transferred to the other rear wheel.

2. The brake control system according to claim 1 wherein said electronic control unit is further operable to calculate a vehicle speed and then to compare said vehicle speed to said front wheel speeds and rear axle speed to determine whether said front wheels and rear axle are encountering excessive slip.

3. The brake control system according to claim 2 wherein said electronic control unit is operable to compare the difference between each front wheel speed and said vehicle speed to a predetermined slip threshold to determine whether either of said front wheels is slipping excessively.

4. The brake control system according to claim 2 wherein said electronic control unit is operable to compare the difference between said rear axle speed and said vehicle speed to a predetermined slip threshold to determine whether either of said rear axle is slipping excessively.

5. The brake control system according to claim 2 wherein said electronic control unit is operable to compare said front wheel speeds and further wherein said electronic control unit is operable in response to detection of excessive slippage to apply the front and rear wheel brakes on the side of the vehicle corresponding to higher front wheel speed.

6. The brake control system according to claim 2 wherein the system is included in a Traction Control system.

7. The brake control system according to claim 2 wherein said electronic control unit is operable, upon detecting excessive slippage of both of the front vehicle wheels, to apply all of the vehicle wheel brakes.

8. A method for controlling an electronic brake control system for a vehicle comprising the steps of:

(a) providing a four channel anti-lock brake system that includes a pair of front wheel speed sensors, with each wheel speed sensor associated with one of the front wheels, and a single rear wheel speed sensor associated with both rear wheels and operative to measure the average speed of the rear wheels;

(b) monitoring the front wheel speeds during a vehicle launch for excessive wheel slip; and

(c) upon detecting excessive slippage of one of the front vehicle wheels and the rear axle, applying the front and rear wheel brakes on the same side of the vehicle as the slipping front wheel, whereby engine torque is transferred to the other rear wheel.

9. A method for controlling an electronic traction control system for a vehicle during launch of the vehicle, the method comprising the steps of:

(a) providing a four channel anti-lock brake system that includes a pair of front wheel speed sensors, with each wheel speed sensor associated with one of the front wheels, and a single rear wheel speed sensor associated with both rear wheels and operative to measure the average speed of the rear wheels;

(b) measuring the rear wheel speed during a vehicle launch;

(c) applying the left rear wheel brake;

(d) measuring the rear wheel speed again;

(e) comparing the rear wheel speeds measured in steps (b) and (d);

(f) releasing the left rear wheel brake upon determining that the rear wheel speed measured in step (d) is greater that the rear wheel speed measured in step (b); and

(g) applying the right rear and right front wheel brakes.

10. The method according to claim 9 wherein the traction control system is included in a four wheel drive vehicle.

11. An electronic brake control system for a vehicle comprising:

a master brake cylinder;

a hydraulic control valve connected to said master brake signal, said control valve including a plurality of solenoid valves for controlling the vehicle wheel brakes;

a plurality of wheel brakes connected to said hydraulic control valve, each of said wheel brakes associated with one of the vehicle wheels and responsive to operation of said solenoid valves in said control valve to brake said associated wheel;

a pair of wheel speed sensors associated with the vehicle front vehicle wheels, each of said wheel speed sensors operative to generate a speed signal that is representative of the rotational speed of one of the front wheels;

a single wheel speed sensor associated with the vehicle rear wheels, said wheel speed sensor operative to generate a speed signal that is representative of the average rotational speed the rear wheels;

a device for detecting the desired turning direction of the vehicle;

a device for detecting the actual turning direction of the vehicle; and

an electronic control unit electrically connected to said control valve, said wheel speed sensors and said turning direction devices, said electronic control unit operative to monitor said turning direction devices and, upon detecting an excessive difference between said desired and actual turning directions during a vehicle turning maneuver, causing said control valve to selectively apply the rear wheel brake that is on the inside of the turn to reduce the difference between said desired and actual turning directions, whereby vehicle understeer is corrected.

12. The brake system according to claim 11 wherein said electronic control unit is electrically connected to an accelerometer, and further wherein said electronic control unit is operable use the output of said accelerometer to determine a normal rear wheel braking load and further wherein said electronic

control unit is operable to limit rear wheel brake application to said normal rear wheel braking load.

13. A method for correcting vehicle understeer comprising the steps of:

(a) providing a four channel anti-lock brake system that includes a pair of front wheel speed sensors, with each wheel speed sensor associated with one of the front wheels, and a single rear wheel speed sensor associated with both rear wheels and operative to measure the average speed of the rear wheels, the system also including devices for detecting the desired and actual turning directions of the vehicle;

(b) measuring the desired turning direction of the vehicle during a vehicle turning maneuver;

(c) measuring the actual turning direction of the vehicle;

(d) comparing the actual turning direction of the vehicle to the desired turning direction of the vehicle;

(e) upon the difference between the actual turning direction of the vehicle and the desired turning direction of the vehicle exceeding a predetermined threshold, applying the vehicle rear wheel brake that is on the inside of the turn to reduce the difference between the actual turning direction of the vehicle and the desired turning direction of the vehicle whereby vehicle understeer is also reduced.

14. An electronic brake control system for a vehicle comprising:

a master brake cylinder;

a hydraulic control valve connected to said master brake signal, said control valve including a plurality of solenoid valves for controlling the vehicle wheel brakes;

a plurality of wheel brakes connected to said hydraulic control valve, each of said wheel brakes associated with one of the vehicle wheels and responsive to operation of said solenoid valves in said control valve to brake said associated wheel;

a pair of wheel speed sensors associated with the vehicle front vehicle wheels, each of said wheel speed sensors operative to generate a speed signal that is representative of the rotational speed of one of the front wheels;

a single wheel speed sensor associated with the vehicle rear wheels, said wheel speed sensor operative to generate a speed signal that is representative of the average rotational speed the rear wheels;

a device for detecting the desired turning direction of the vehicle; and

an electronic control unit electrically connected to said control valve, said wheel speed sensors and said turning direction device, said electronic control unit operative to monitor said turning direction devices and said rear wheel speed and, upon detecting an excessive determining an excessive slippage of said rear wheels during a turning maneuver, causing said control valve to selectively apply the rear wheel brake that is on the inside of the turn, whereby torque is transferred to the opposite side of the vehicle.